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For: METHOD AND ARRANGEMENT FOR INDICATING SERVICE SPECIFICITY FOR PDP CONTEXTS

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Attached please find the certified copy of the foreign application from which priority is claimed for this case:

Country	: Finland
Application Number	: 991364
Filing Date	: 14 June 1999

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SIGNATURE OF ATTORNEY

Reg. No.: 24,622

Clarence A. Green

Type or print name of attorney

Tel. No.: (203) 259-1800

Perman & Green, LLP

Customer No. 2512

P.O. Address

425 Post Road, Fairfield, CT 06430

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E T U O I K E U S T O D I S T U S
P R I O R I T Y D O C U M E N T

Hakija Applicant	**Nokia Mobile Phones Ltd** **Espoo**
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Kansainvälinen luokka International class	**H04Q**

Keksinnön nimitys
Title of invention

"Method and arrangement for indicating service specificity for PDP Contexts"
(Menetelmä ja järjestelmä PDP-kontekstien palvelutarkoituksen ilmaiseksi)

Täten todistetaan, että oheiset asiakirjat ovat tarkkoja jäljennöksiä patentti- ja rekisterihallitukselle alkuaan annetuista selityksestä, patenttivaatimuksista, tiivistelmästä ja piirustuksista.

This is to certify that the annexed documents are true copies of the description, claims, abstract and drawings originally filed with the Finnish Patent Office.

Pirjo Kaila
Tutkimussihteeri

Maksu 300,- mk
Fee 300,- FIM

Osoite: Arkadiankatu 6 A, P.O.Box 1160, FIN-00101 Helsinki, FINLAND
Puhelin: 09 6939 500
Telephone: + 358 9 6939 500
Telefax: 09 6939 5328
Telefax: + 358 9 6939 5328

Method and arrangement for indicating service specificity for PDP Contexts

Menetelmä ja järjestelmä PDP-kontekstien palvelutarkoituksen ilmaisemiseksi

Metod och arrangemang för att uppge tjänstfunktion för PDP-kontexter

The invention concerns the technological field of managing the PDP Contexts and similar communication connections based on packet-switched bearer services between a mobile station and a fixed packet-switched network. Especially the invention concerns the task of indicating the specific use of PDP Contexts having the same PDP Type for e.g. charging purposes.

Fig. 1 illustrates some system aspects of a known proposal for arranging the communication connections between a mobile station 101 or 102 and a fixed packet-switched network. In Fig. 1 each mobile station or MS (or User Equipment or UE as in the UMTS specifications) is operating in a cellular telephone system of its own: UE 101 is a UMTS terminal operating in a UMTS network 103 and MS 102 is an enhanced GSM terminal operating in an enhanced GSM network 104. From both networks there is a connection to a GPRS network 105. The UMTS network 103 comprises a UTRAN or UMTS Terrestrial Radio Access Network 106 as well as a CN or Core Network 107. In the enhanced GSM network 104 a BSS or Base Station Subsystem 108 and an MSC or a Mobile Switching Centre 109 are shown. The detailed structure of the network elements is unessential to the present invention, but it is known that for example a UTRAN consists of a number of Radio Network Subsystems, each of which in turn comprises a Radio Network Controller and a number of Node Bs roughly corresponding to base stations. A BSS in turn comprises a Base Station Controller and a number of Base Transceiver Stations operating under it. Various mixed-mode cellular telephone systems are possible; for example the BSS 108 might operate under the same CN as the UTRAN 106. The mobile stations shown in Fig. 1 could also be exactly similar terminals operating close to each other in a single cell.

In Fig. 1 there is a connection both from the UTRAN 106 and from the BSS 108 to a corresponding SGSN or Serving GPRS Support Node 110 and 111. It is known to have a certain Packet Control Unit or PCU in the Base Station Subsystem and/or the UTRAN to act as a gateway to and from the SGSN. Both SGSNs 110 and 111 are in turn coupled, through the GPRS trunk lines, to a GGSN or Gateway GPRS Support

Node 112 which may also have other functions: in Fig. 1 it is shown to operate as an MMSC or a Multimedia Messaging Service Center for the sake of example. The MSs may be coupled to different GGSN or they may be coupled to the same GGSN through the same SGSN; various communication configurations are available as is well known by the person skilled in the art.

Setting up an active communication connection between a terminal and the fixed packet-switched network, i.e. using a mobile station to access the packet data services offered through the fixed packet-switched network, means that a so-called PDP Context has to be set up between the mobile station and a GGSN. Setting up PDP Contexts is known as such, and the setup proceeds through a known and documented exchange of messages between the mobile station and the GGSN. Specifically, the mobile station transmits an Activate PDP Context Request message in a way basically known as such. The BSS or UTRAN recognizes the Activate PDP Context Request message as concerning packet-switched services and consequently routes it to the current SGSN in a known way, e.g. through a PCU. The SGSN selects a GGSN based on the HLR (Home Location Register) records associated with the mobile station and/or an MS-provided APN (Access Point Name) string. When the GGSN receives the message it checks, among others the context type that the mobile station has requested. Known context types at the priority date of this patent application are IP for using Internet Protocol based services, X.25 for using X.25-protocol based services and OSP (Octet Stream Protocol) for using unstructured octet streams as the carrier for some otherwise unspecified services.

The GGSN may select an external network element as the actual provider of the requested service, based on the APN and/or the PDP Configuration Options field in the context activation request. For some services also the GGSN may act as the service provider. The GGSN creates an association with the service attributes and the established "tunnel" or PDP Context between it and the mobile station. If the actual service provider is somewhere else in the network, the extension of this tunnel is the network connection (which itself is also a tunnel) between the GGSN and the service provider.

After the service has been activated and possibly some service-related parameters have been configured (e.g. according to the information delivered in the Protocol Configuration Options information element included in the setup request message in a known manner), the GGSN sends a PDP Context Activation Response message via the SGSN to the MS. The reception of this message at the MS finalizes the

context activation. After that, there is a logical tunnel in place between the MS and the MMSC, where messages can be delivered transparently.

The activation of the PDP Context may also take place upon the initiative of a service provider or other fixed network element. An example is a case where a message has been stored for delivery to an MS which currently does not have an active PDP Context with the messaging center. According to the adopted practice within GPRS, the MS is always the one to transmit the initial Activate PDP Context Request message, but it is possible for the messaging center or other network element to indicate to the MS through a simple signalling message that there is a stored message waiting for delivery, or that some other service is provided to the MS. It is then left to the MS's discretion to choose the moment for activating the PDP Context by commencing the procedures explained above. In other network arrangements a network-originating PDP Context activation (though probably with different designations of the participating devices and associated messages) could be nearly identical to the MS-originating one described above. The identification information in the activation request would serve to identify a particular MS instead of a SGSN-GGSN-MMSC combination, whereby the routing of the message could involve the known inquiries to the location registers which store the current location information of the MS.

It is known that a mobile station may have several PDP Contexts active at any moment. There are no limitations to the Type attributes of these contexts, so there may even be several simultaneous active PDP Contexts of the same type.

The SGSNs and GGSNs collect charging information for each PDP Context separately. The problem of the known methods and arrangements for managing PDP Contexts is that there are no effective ways of associating a certain PDP Context with certain service or detailed service type in order for the network operator to arrange the charging according to actual usage of services.

There are naturally the known PDP Context Type attribute separately associated with each active PDP Context, as well as the QoS or Quality of Service profile which consists of certain service attributes and which could be indirectly used to indicate the service type. However, the known value space for PDP Context Type attributes is very limited and it is not feasible to extend it to cover a broad selection of possibly dynamically changing service alternatives. Using a QoS profile to characterize a service type is not reliable since there are no guarantees that such a

"QoS profile -> service type" mapping would be unambiguous: several different services or service types may require exactly same QoS profiled despite of them being clearly different from the charging point of view. The solution of using PDP addresses for identifying services is not feasible, because e.g. IP-based services are often associated with dynamically allocated IP addresses: it would be very difficult to maintain an up-to-date mapping table between dynamically allocated IP addresses and certain services. Static IP addresses are also not feasible due to the limited IP address space. In addition, some mobile stations may not be able to handle several IP-addresses simultaneously.

It is an object of the present invention to provide a method and an arrangement for unambiguously indicating the specific use of a certain PDP Context or similar communication connection based on packet-switched bearer services between a mobile station and a fixed packet-switched network. It is an additional object of the invention that it does not require extensive reformulation of the standards existing at the priority date of this patent application, especially concerning the standards of GPRS and UMTS.

The objects of the invention are achieved by transmitting the indication of specific use within one of the context activation messages, preferably as a subvalue associated with an existing PDP Context Type value or as one of the PDP Configuration Options.

The method according to the invention is characterized in that it comprises the step of transmitting within a service type indicator field an indicator that partly consists of a service type indicator value and partly consists of a second indicator value indicating the specific use of a packet-switched communication connection the setup of which is requested with a setup request message.

The invention also applies to an arrangement with the characteristic means for transmitting, within a service type indicator field of a setup request message, an indicator that partly consists of a service type indicator value and partly consists of a second indicator value indicating the specific use of a packet-switched communication connection the setup of which is requested with the setup request message.

The invention is based on the insight that there has already been specified certain mechanisms for exchanging information between the devices that are to take part in

a PDP Context that is set up. By using these mechanisms and making novel and inventive additions thereto it is even rather straightforward to unambiguously indicate a specific use for each active PDP Context.

Especially there has already been defined the indication of PDP Context Type in the Activate PDP Context Request message transmitted by the mobile station. Instead of defining completely new values we suggest that the existing values are allowed to have optional extensions that identify the specific use of the service. For example the known IP type for PDP Contexts may be defined to comprise subtypes like IP:MMS for Multimedia Messaging Services, IP:WAP for Wireless Application Protocol based services and so on. It is advantageous to define the indication of the subtypes so that an older or simpler network element that is only capable of recognizing the basic types (IP, X.25, OSP) may simply ignore the extension that defines the subtype.

The use of subtypes that are defined to fall within the categories defined by the existing types a remarkable burden of standard reformulation is avoided, because the handling of the known types may be left as it is. It is straightforward to apply the instructions given in this patent application to amend the programs that form an embedded part of the network elements and control the operation thereof so that in addition of recognizing the "main" type and handling the PDP Context accordingly in a known fashion they also read the subtype and store it for example as a part of the charging information.

An alternative way of indicating the specific use of a certain PDP Context is to define a corresponding configuration parameter that is transmitted within the appropriate field of the Activate PDP Context Request message together with known configuration parameters. This approach may cause the Activate PDP Context Request message to be longer that the most preferable "subtype" alternative described above, since the addition of a new configuration parameter may require more side information like parameter count, parameter length, parameter ID and so on to be added into the message.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended Claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

Fig. 1 illustrates a known network arrangement,

Fig. 2 illustrates an exchange of messages according to an advantageous embodiment of the invention,

Fig. 3 illustrates an activation request message according to the invention and

Fig. 4 illustrates an arrangement according to the invention.

Fig. 1 has been discussed above in the description of prior art, so in the following we will mainly concetrate on Figs. 2, 3 and 4.

Fig. 2 illustrates an exchange of messages between a MS and a GGSN through a BSS and an SGSN. At step 201 the MS transmits an Activate PDP Context Request message which is illustrated in more detail in Fig. 3 and preferably contains at least the following information:

* The Network Service Access Point Identifier or NSAPI 301 is selected by the MS. NSAPI identifies the PDP context to be activated within the GPRS/UMTS network. For identifying the user the message comprises also the TLLI (Temporary Logical Link Identity) and IMSI (International Mobile Subscriber Identity) information elements (not shown in Fig. 3).

* The PDP Type 302 shall have a two-part value. The first part 302a is a main value that shall identify the protocol; typical main values are the predefined identifiers of the IP, X.25 and OSP protocols. The second part 302b shall identify the service being used according to the most preferable embodiment of the invention. The second part may be used as a guide to the charging scheme to be applied for the service. The SGSN may also use it for selecting a proper GGSN (for example a one with MMSC capabilities) that can provide the service. The two-part value of the PDP Type field can be expressed as XX:YYY, where XX is the main value and YYY is the extension according to this embodiment of the invention.

* The PDP Address field 303 is most advantageously empty.

* The Access Point Name or APN 304 is selected by the MS. The selected APN identifies the GGSN and possible other service provider which the MS wants to use for this context. The actual APN to be used (i.e. GGSN and possible additional service provider to be used) can be restricted by the operator by subscription. If that is the case, the HLR (Home Location Register) record of each user includes the APN information identifying the GGSNs and service providers that should always

be used; they may naturally be different for different services or service classes. The MS may omit the APN from the Activate PDP Context Request message if the APN is configured in the HLR. Otherwise the user may include an APN in the message. If there is no APN in the message and no APN is configured in the HLR, the SGSN is free to choose any GGSN and other service provider to be used (if Dynamic Allocation in the visited network is allowed by the HLR record).

* The QoS Requested 305 (where QoS comes from Quality of Service) is selected by the MS. The requested service quality comprises a number of factors and their selection typically depends on the desired characteristics of the service. Among the subjects to be considered are the eventual need for RLC&LLC retransmissions, the use of UDP (User Datagram Protocol) at the GPRS backbone network, bit rates, delay class and service precedence.

* The PDP Configuration Options field 306 can be used e.g. for informing the GGSN and/or service provider about certain capabilities of the MS, such as supported content-types etc. General configuration information can be included in this information element if these are not implemented into the applied protocol itself. If there are many choices for the applied protocol (either totally separate protocols or different versions of the same protocol), the PDP Configuration options can be used for informing the GGSN and/or the service provider which protocol(s) the MS supports. An alternative embodiment of the invention is to provide the specific service type identifier as a part of this field instead of using the two-part value for the PDP Type field 302. Such provision of specific service type identifier could mean for example the addition of "Service=YYY" into the PDP Configuration Options field 306, where YYY is again an identifier of a specific service.

At step 202 the BSS recognizes the Activate PDP Context Request message as concerning packet-switched services and consequently routes it to the current SGSN in a known way. At step 203 the SGSN selects the GGSN based on the HLR records and/or the MS-provided APN string. At step 204 the GGSN receives the message and recognizes from the indicator according to the invention which specific service type is involved. The GGSN decides to provide the service by itself or to select an external service provider based on the APN and/or the PDP Configuration Options field in the context activation request. The GGSN creates an association with the service attributes and the established tunnel (identified by TID consisting of the user's IMSI and the NSAPI value of the PDP context). The eventual extension of this tunnel is the network connection (which itself is also a tunnel) to the external service provider.

After the service has been activated and possibly some MMS-related parameters have been configured (e.g. according to the information delivered in the Protocol Configuration Options information element), the GGSN sends at step 205 a PDP Context Activation Response message via the SGSN to the MS. The reception 206 of this message at the MS finalizes the context activation. No PDP address need to be assigned for the context, although such an assignment is not precluded by the invention. After that, there is a logical tunnel in place between the MS and the GGSN or other service provider, where messages can be delivered transparently as illustrated by block 207.

The identifier of the specific service type is stored at least in the GGSN and preferably also in the SGSN. These devices may use it for example for charging purposes which is schematically illustrated by blocs 208 and 209. This means that when the SGSN and GGSN are storing charging information (duration of connection, starting and ending times, peer identifier etc.), in a way otherwise known as such, they also store the identifier of the specific service type separately for each PDP Context. After that it easy to make a computer run through the stored records and charge the subscriber responsible for the terminal for all used services according to a predefined charging schedule.

Fig. 4 illustrates an arrangement according to the invention comprising a terminal or MS (or UE) 401, a BSS or UTRAN 402, a SGSN 403 and a GGSN 404. The hardware of the terminal comprises a radio transceiver block 412, a decoding/demultiplexing block 413, an encoding/multiplexing block 414, a control block 415 and a user data part 416. The decoding/demultiplexing block 413 is arranged to separate received signalling information from received user data and to direct the former into the control block 415; similarly the encoding/multiplexing block 414 is arranged to take signalling information from the control block 415 and to multiplex it for transmission with user data coming from the user data part 416. All other blocks operate under the supervision of the control block. The control connections are shown with thinner lines than the user data and signalling information connections. The present invention is implemeted in the terminal so that the control block 415 is instructed to add the specific service type identifer to all Activate PDP Context Request messages it will compose; this is done by programming the corresponding operations into a memory in the form of machine-readable processing instructions. If the terminal arrangement comprises a number of separate functional entities, the control block may be understood to consist of the

control functions distributed into the physical controlling entities of the separate devices.

The GGSN is basically a large-capacity data storage 421 with a transmission unit 422 arranged to couple it to the trunk lines of the GPRS network (or a corresponding packet data network) as well as a control unit 423 to control the setting up, maintaining and tearing down of connections. The control block 423 may be made to recognize specific service type identifers from Activate PDP Context Request messages by programming the corresponding operations into a memory in the form of machine-readable processing instructions. The data storage 421 may be used to store the specific service type identifers in association with e.g. charging information.

The invention has bee described above exclusively with reference to GPRS and UMTS terminology. However, the invention is equally applicable to all such systems where the setup request message for a new packet-switched communication connection comprises a type field for which a limited set of main values have been defined. The invention has also been described only with references to an Activate PDP Context Request message that is transmitted as the indication of the need for a completely new PDP Context; however a similar message may be transmitted when one of the communicating parties has found that the chatracteristics of the existing PDP Context are not optimal for the current use of the PDP Context, so that the "activate" message actually means that the characteristics of an existing PDP Context must be redefined.

Claims

1. A method for indicating the specific use of a packet-switched communication connection between a mobile station (401) and a fixed packet-switched data transmission network, where the setup of a new packet-switched communication connection involves the step of transmitting (201) a setup request message with a service type indicator field (302) for which a set of service type indicator values have been defined, **characterized** in that it comprises the step of
- transmitting within the service type indicator field (302) an indicator that partly consists of a service type indicator value (302a) and partly consists of a second indicator value (302b) indicating the specific use of the packet-switched communication connection the setup of which is requested with the setup request message.

2. A method according to claim 1, **characterized** in that the setup request message is an Activate PDP Context Request message and the service type indicator field is a PDP Type field (302).

3. A method according to claim 1, **characterized** in that it additionally comprises the step of
- storing (208, 209) said second indicator value indicating the specific use of the packet-switched communication connection in association with a set of information used to charge a subscriber of the fixed packet-switched data transmission network for the use of services provided through the fixed packet-switched data transmission network.

4. A method according to claim 3, **characterized** in that said step of storing said second indicator value in association with a set of information used to charge a subscriber is accomplished in a Gateway GPRS Supporting Node (404) of a GPRS network.

5. A method according to claim 3, **characterized** in that said step of storing said second indicator value in association with a set of information used to charge a subscriber is accomplished in a Serving GPRS Supporting Node (403) of a GPRS network.

6. An arrangement for providing packet-switched communication connections between a mobile station (401) and a fixed packet-switched data transmission network and for indicating the specific use of a packet-switched communication

connection, comprising means (415, 414, 412) for transmitting a setup request message as an indicator for the need of setting up of a new packet-switched communication connection, **characterized** in that it comprises means (415) for transmitting, within a service type indicator field of the setup request message, an indicator (302) that partly consists of a service type indicator value (302a) and partly consists of a second indicator value (302b) indicating the specific use of the packet-switched communication connection the setup of which is requested with the setup request message.

7. An arrangement according to claim 6, **characterized** in that it comprises a Serving GPRS Support Node (403) and a Gateway GPRS Support Node (404) and in at least one of them means (421) for storing said second indicator value indicating the specific use of the packet-switched communication connection in association with a set of information used to charge a subscriber of the fixed packet-switched data transmission network for the use of services provided through the fixed packet-switched data transmission network.

Abstract

A method and an arrangement are provided for indicating the specific use of a packet-switched communication connection between a mobile station (401) and a fixed packet-switched data transmission network. The setup of a new packet-switched communication connection involves the step of transmitting (201) a setup request message with a service type indicator field (302) for which a set of service type indicator values have been defined. An additional step is performed for transmitting within the service type indicator field (302) an indicator that partly consists of a service type indicator value (302a) and partly consists of a second indicator value (302b) indicating the specific use of the packet-switched communication connection the setup of which is requested with the setup request message.

Fig. 3

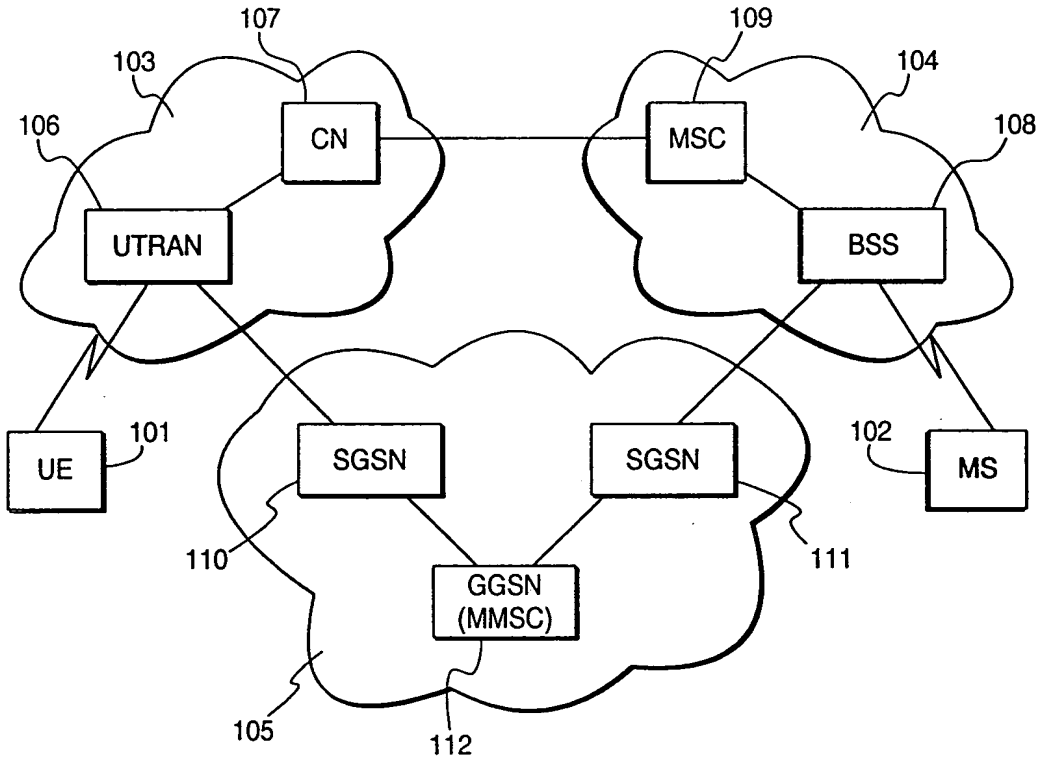

Fig. 1
PRIOR ART

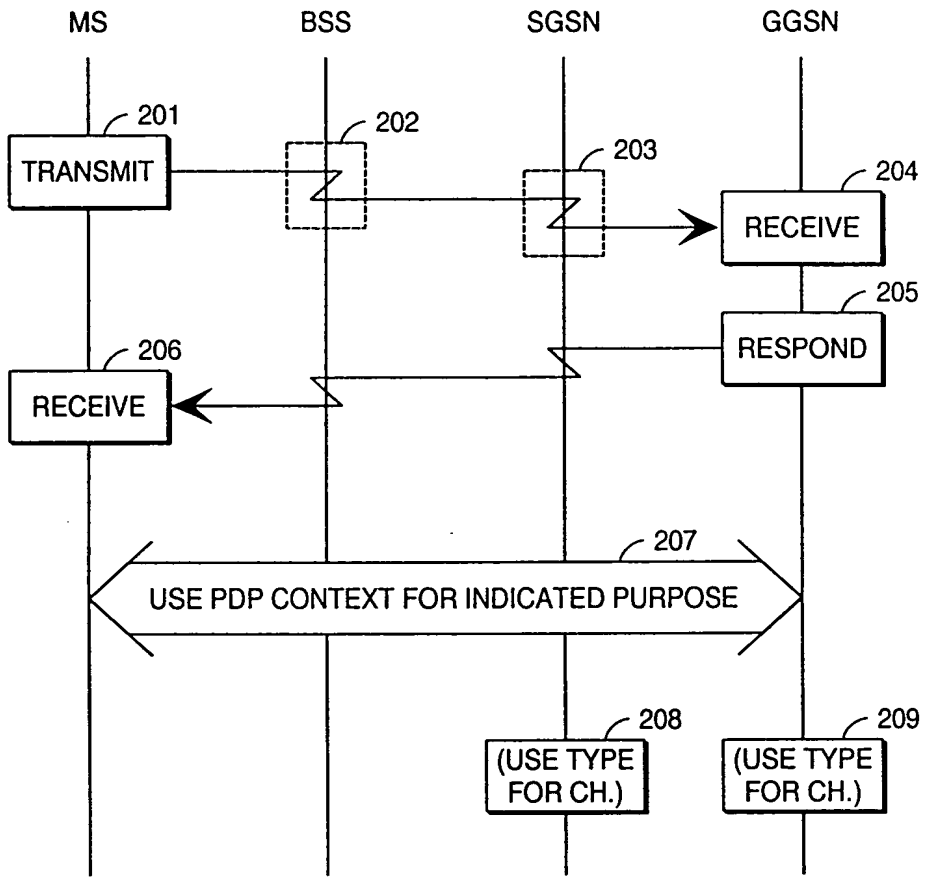
MS
BSS
SGSN
GGSN
201
TRANSMIT
202
203
204
RECEIVE
205
RESPOND
206
RECEIVE
207
USE PDP CONTEXT FOR INDICATED PURPOSE
208
(USE TYPE FOR CH.)
209
(USE TYPE FOR CH.)

Fig. 2

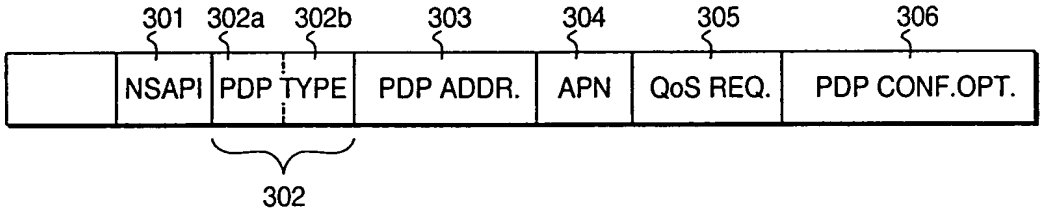
301
302a
302b
303
304
305
306
NSAPI
PDP TYPE
PDP ADDR.
APN
QoS REQ.
PDP CONF.OPT.
302

Fig. 3

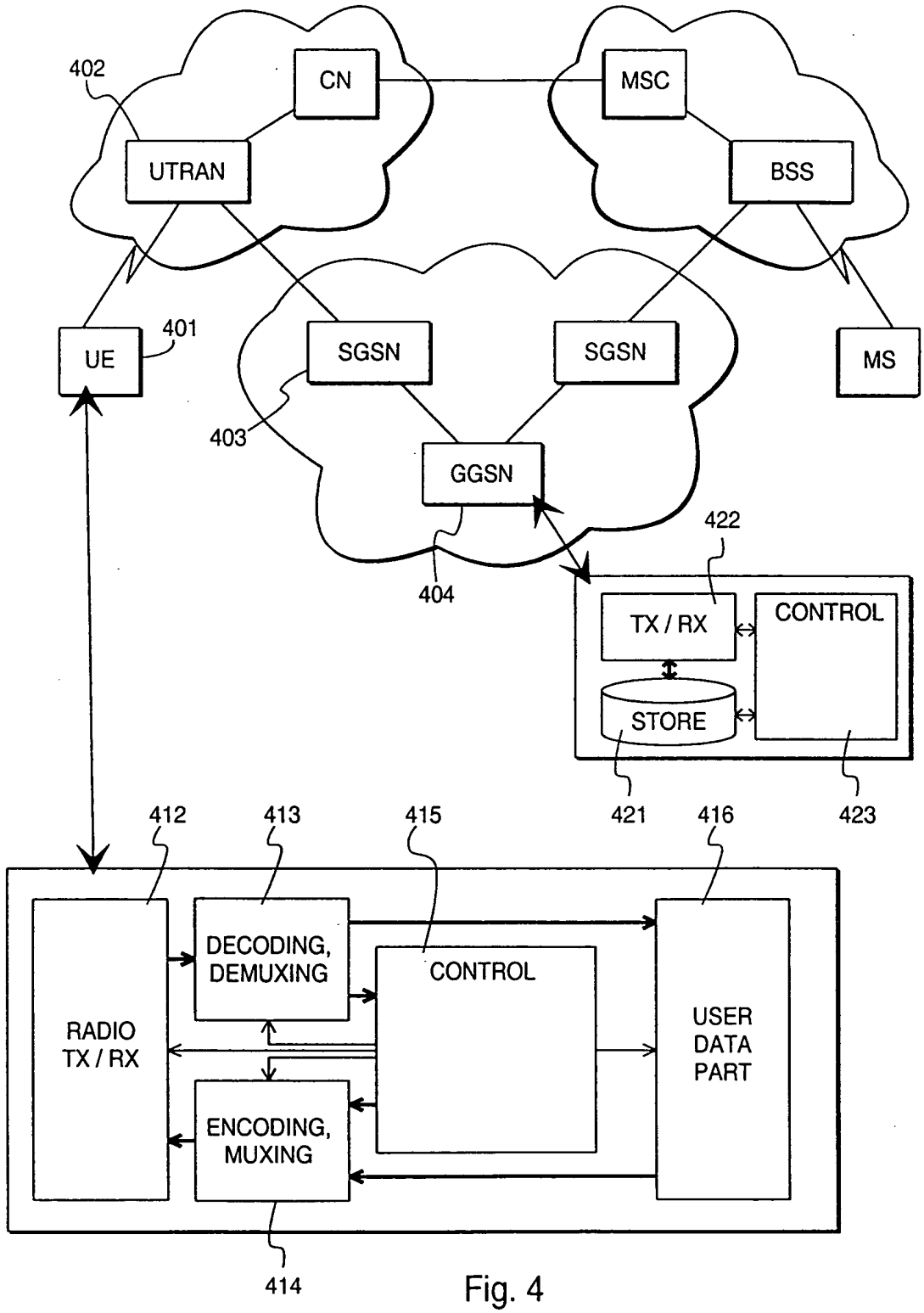
402
CN
MSC
UTRAN
BSS
UE
401
SGSN
SGSN
MS
403
GGSN
404
422
TX / RX
CONTROL
STORE
421
423
412
413
415
416
RADIO
TX / RX
DECODING,
DEMUXING
CONTROL
USER
DATA
PART
ENCODING,
MUXING
414

Fig. 4